AREI UPDATES: New Crop Varieties

Updates on Agricultural Resources and Environmental Indicators

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Intellectual Property Rights Spur Development of New Crop Varieties

- **Expanded legal protection for new crop varieties has stimulated private sector breeding efforts during the past 25 years.**
- **Private sector research expenditures for plant breeding dramatically increased between 1960 and 1992. Most of these expenditures were for developing new varieties of corn, vegetables, and soybeans.**
- **Substantial increases also occurred in the number of Plant Patents, Plant Variety Protection Certificates, and Utility Patents issued for new plants and plant varieties between 1971 and 1994.**

Legislation governing intellectual property rights for biological inventions (see box), and the development of hybrid seeds and biotechnology applications, have stimulated private companies to invest in plant breeding. Private sector investments for plant breeding increased from $6 million in 1960 to $400 million in 1992 (table 1). Nearly 70 percent of private sector plant breeding research expenditures in 1989 were for corn, vegetables, and soybeans (table 2). Private sector expenditures on agricultural biotechnology research also rose to about $595 million in 1992 from almost nothing in the mid-1970s.

The Plant Patent Act of 1930 and the Plant Variety Protection Act (PVPA) of 1970 established plant breeders' rights for new plants and plant varieties. In 1980, a Supreme Court decision authorized the use of Utility Patents for biological inventions. The number of Plant Patents, Plant Variety Protection Certificates (PVPCs), and Utility Patents issued over the last 25 years has been increasing dramatically (see figure).

The PVPA stimulated the development of new crop varieties. The number of PVPCs issued for new varieties of field crops, grasses and vegetables climbed from 153 in 1971-1974 to 992 in 1991-1994 (table 3). By the end of 1994, a total of 3,306 PVPCs had been issued for new crop varieties. New soybean, corn, and vegetable varieties accounted for 57 percent of total PVPCs awarded. The private sector owns approximately 87 percent of total PVPCs. Oats was the only crop that the public sector held a higher share of PVPCs, about 64 percent.

By December 1994, 324 Utility Patents had been issued for multicellular organisms (table 4). Of these, 286 were issued for new plants or plant parts and 38 were issued for animals. As with PVPCs, most of the Utility Patents were awarded to the private sector (table 5).

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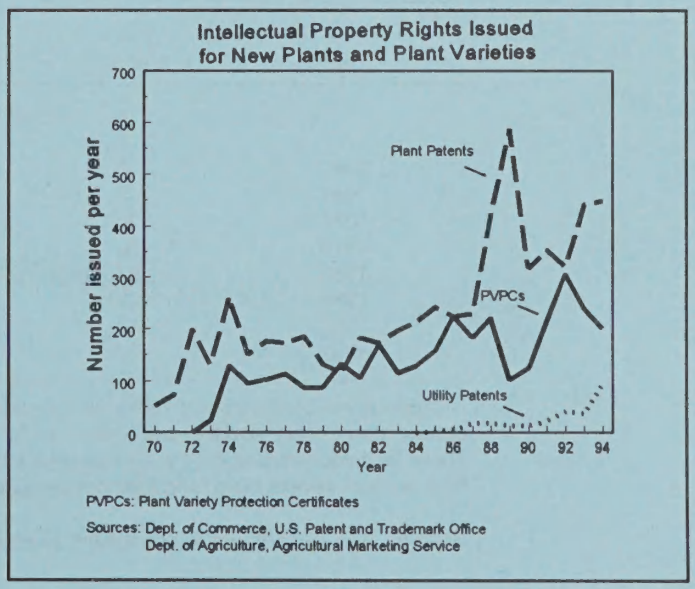
About AREI UPDATES

AREI UPDATES is a periodic series that supplements and updates information in **Agricultural Resources and Environmental Indicators (AREI)**, USDA, ERS, AH-705, Dec. 1994. **UPDATES** report recent data from surveys of farm operators and others knowledgeable about changing agricultural resource use and conditions, with only minimal interpretation or analysis. Please contact the individual listed at the end of the text for additional information about the data in this **UPDATE**. If you would like to be added to the mailing list or have other questions about **AREI UPDATES** or **AREI**, contact Richard Magleby, (202) 219-0436.



Intellectual Property Rights for New Plant Varieties and Biological Inventions

Utility Patents

The Patent Act of 1790 and its subsequent amendments established a system of intellectual property rights to encourage inventors and manufacturers to develop new industrial inputs and consumer products. Utility Patents are administered by the Patent and Trademark Office (PTO) of the U.S. Department of Commerce and grant ownership of new inputs and products for 20 years. Biological inventions were not patentable until 1980 when a decision by the Supreme Court in *Diamond vs. Chakrabarty* authorized the use of Utility Patents for microorganisms. In 1985 the PTO's Board of Appeals and Interferences approved the use of Utility Patents for plants, and in 1987 for animals. Although Utility Patents offer owners the strongest form of protection for new plant varieties, they are more difficult to acquire compared with other options for procuring plant breeders' rights.

Plant Patents

The Plant Patent Act amended the Patent Act of 1790 and provided plant breeders' protection for 17 years for asexually reproduced plant varieties, specifically fruits, nuts, and ornamentals, but excluding tuber crops. Like Utility Patents, Plant Patents are administered by the Patent and Trademark Office (PTO) of the U.S. Department of Commerce.

Plant Variety Protection Certificates (PVPCs)

The Plant Variety Protection Act (PVPA) of 1970 provided for the issuance of PVPCs establishing plant breeders' rights for new plant varieties produced from seed, particularly field crops. PVPCs are awarded for new plant varieties determined to be distinct, uniform, and stable. A 1980 amendment extended coverage to vegetables. Amendments in 1994 restricted farmer rights to resell protected seed, provided protection for tuber crops, and extended property rights protection from 17 to 20 years. A provision was also added to protect plant breeders from cosmetic infringements or superficial changes in the appearance of protected plant varieties that do not increase its yield or value. A 1995 Supreme Court decision, *Asgrow vs. Winterboer*, further restricted farmer rights to resell protected seed. PVPCs are administered by the U.S. Department of Agriculture.

Table 1—Private investment in biological research for agriculture

Year	Plant breeding	Agricultural biotechnology[1]
	Million dollars	
1960	6	--
1965	9	--
1970	26	--
1975	50	--
1980	97	--
1985	179	347
1990	314	516
1992	400	595

[1]Agricultural biotechnology refers to the use of genetic engineering, tissue culture, monoclonal antibodies, and biosensors for food and agricultural purposes. These techniques are applied in several product areas, including plant breeding, food product development, and livestock research.

Source: U.S. Department of Agriculture, Economic Research Service

Table 2—Private plant breeding in the United States, 1982 and 1989

Crop	Companies		Ph.D. scientists		Expenditures (est.)	
	1982	1989	1982	1989	1982	1989
	----------Number----------				------Million dollars------	
Corn	66	75	155	257	$43.8	$112.9
Vegetables	44	37	96	108	24.7	53.6
Soybeans	26	34	36	60	9.1	24.9
Wheat	21	11	23	25	6.7	13.5
Alfalfa-forage legumes	14	16	23	28	5.9	13.3
Sorghum	21	15	22	23	6.3	12.6
Sugar beets	5	10	14	22	1.7	9.8
Turf grass	8	16	9	8	1.7	5.9
Flowers-ornamentals	9	9	5	8	1.9	5.9
Sunflowers	16	9	15	7	4.1	4.8
Cotton	13	11	17	11	4.6	4.6
Rice	5	4	7	9	1.4	3.7
Canola	0	6	0	4	0.0	2.4
Oats, barley, rye, triticale	11	6	7	5	1.5	2.3
Forage grasses	5	8	2	2	0.8	0.8
Peanuts	0	1	0	1	0.0	0.5
Safflower	3	2	2	1	0.4	0.4
Fruits	2	2	0	0	0.5	0.1
Total			434	580	$115.1	$272.0

Source: Derived from Kalton, Richardson, and Frey (1989), "Inputs in Private Sector Plant Breeding and Biotechnology Research in the United States," *Diversity*, Vol. 5, No. 4, pp. 22-37. Kalton, Richardson, and Frey report only an estimate of total expenditures for plant breeding and data on scientist-years. To compute expenditures for individual commodities, the total breeding expenditure was multiplied by the proportion of all scientific full-time equivalents working on each crop. A weight of 1.0, 0.7, and 0.5 was given to each Ph.D., M.S., and B.A. scientist-year, respectively, to compute the proportions. Private breeding for fruits and flowers is likely to be underestimated because only breeding by companies and not individuals is included.

Table 3—Plant Variety Protection Certificates issued for new crop varieties

Crop	Certificates issued							Certificate ownership	
	1971-74	1975-78	1979-82	1983-86	1987-90	1991-94	Total	Private	Public
	----------Number----------							------Percent------	
Field crops:									
Soybeans	34	69	132	150	114	162	661	84	16
Corn	0	1	6	50	104	161	322	100	0
Wheat	12	52	59	30	74	87	314	68	32
Cotton	24	35	41	38	34	39	211	87	13
Barley	0	12	2	22	6	35	77	82	18
Beans, field	0	1	5	18	10	28	62	77	23
Oats	0	10	6	0	9	8	33	36	64
Rice	0	8	4	2	5	15	34	100	0
Sorghum	0	0	0	0	2	31	33	100	0
Canola	0	0	0	2	8	15	25	72	28
Safflower	0	3	2	1	5	6	17	88	12
Other field crops	0	16	15	13	18	13	75	85	15
Total field crops	70	207	272	326	389	600	1,864	84	16
Grasses and forage crops:									
Fescue	0	5	16	28	38	30	117	90	10
Ryegrass	0	10	13	35	26	14	98	95	5
Alfalfa	0	3	22	16	30	11	82	84	16
Bluegrass	0	8	11	11	13	20	63	89	11
Other grasses	0	8	18	5	14	13	58	57	43
Total grasses	0	34	80	95	121	88	418	85	15
Vegetables:									
Peas	20	54	43	66	16	51	250	100	0
Beans, garden	31	39	20	29	21	70	210	100	0
Lettuce	13	16	14	17	32	70	162	100	0
Other vegetables	2	29	46	72	43	71	263	80	20
Total vegetables	66	138	123	184	112	262	885	94	6
Ornamentals:	17	31	18	18	13	42	139	94	6
Total	153	410	493	623	635	992	3,306	87	13

Source: U.S. Department of Agriculture, Agricultural Marketing Service

Table 4—Utility Patents issued for multicellular organisms through 1994

Technology[1]		Commodity[2]	
	Number		Number
Animal	38	Corn	83
		Tomato	24
Plant	286	Tobacco	23
Plant, seedling, or plant part	154	Soybean	17
Recombinant plant	103	Rice	15
Somatic cell fusion-derived plant	10	Sunflower	10
Mutant plant	25	Potato	9
Grafted plant	3	Wheat	8
		Canola	8
All	324	Cotton	8
		Mushrooms	8

[1]A single patent may involve more than one technology or commodity.
[2]Only commodities with 8 or more patents are listed.

Source: U.S. Department of Commerce, Patent and Trademark Office

Table 5—Ownership profile of Utility Patents issued for multicellular organisms through 1994

Country	Private	Public	All
		Number	
U.S.	204	48	252
Foreign	63	9	72
All	267	57	324

Source: U.S. Department of Commerce, Patent and Trademark Office

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